TECHNICAL FISHERY REPORT 91-02

Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 3-2000
Juneau, Alaska 99802

February 1991

Norton Sound and Kotzebue Sound Management Area

Salmon Catch and Escapement Statistics, 1988

by

Lawrence S. Buklis

The Technical Fishery Report Series was established in 1987, replacing the Technical Data Report Series. The scope of this new series has been broadened to include reports that may contain data analysis, although data oriented reports lacking substantial analysis will continue to be included. The new series maintains an emphasis on timely reporting of recently gathered information, and this may sometimes require use of data subject to minor future adjustments. Reports published in this series are generally interim, annual, or iterative rather than final reports summarizing a completed study or project. They are technically oriented and intended for use primarily by fishery professionals and technically oriented fishing industry representatives. Publications in this series have received several editorial reviews and at least one *blind* peer review refereed by the division's editor and have been determined to be consistent with the division's publication policies and standards.

Norton Sound and Kotzebue Sound Management Area

Salmon Catch and Escapement Statistics, 1988

By

Lawrence S. Buklis

Technical Fisheries Report No. 91-02

Alaska Department of Fish and Game
Commercial Fisheries Division
Juneau, Alaska

February 1991

(Page intentionally left blank)

AUTHOR

Lawrence S. Buklis is Region III Regional Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 333 Raspberry Road, Anchorage, AK 99518.

ACKNOWLEDGMENTS

The author would like to thank the Norton Sound-Kotzebue Sound Area staff for field data collection and ageing of all scale samples. Helen Hamner provided an electronic copy of the prior year report, and Charlie Lean reviewed the preliminary draft of this report. Bob Wilbur, editor for the Division of Commercial Fisheries, facilitated final review and publication.

(Page intentionally left blank)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The 1988 commercial and subsistence harvest of the five species of Pacific salmon (*Oncorhynchus*) found in the Norton Sound-Kotzebue Sound Area are presented by age, sex, and length. The 1988 Norton Sound District commercial harvest totaled 225,165 salmon and was comprised of 4,096 chinook, 107,996 chum, 74,604 pink, 1,252 sockeye, and 37,247 coho salmon. The commercial harvest was 60% below the recent 5-year (1983-87) average for chinook salmon, 37% below for chum salmon, and near average for coho salmon. A record high harvest for sockeye salmon was achieved. The commercial pink salmon harvest was 53% above the 1983-87 average, but 48% below the 1978-87 average, which includes an equal number of even and odd numbered years. Escapements for pink and coho salmon were better than average, while chinook and chum salmon escapements ranged from below to above average in the various index areas. The chinook salmon harvest in the Unalakleet Subdistrict of Norton Sound was predominantly ages 1.4 (56.7%) and 1.3 (30.2%). Chum salmon harvest in the Unalakleet Subdistrict consisted of primarily ages 0.3 (60.5%) and 0.4 (36.8%) fish. The coho harvest was mostly age 2.1 (93.5%), with no age-1.1 fish observed in the sample. In the Kotzebue District the harvest totaled 352,915 chum salmon and 152 chinook salmon. The chum salmon harvest was above the recent 10-year average of 310,400 fish. Escapements of chum salmon in the Kotzebue District appeared to be about average based on limited information. The age composition of the chum salmon harvest in the Kotzebue District commercial fishery was 6.1% age 0.2, 74.7% age 0.3, 17.2% age 0.4, 1.9% age 0.5, and 0.1% age 0.6. The occurence of age 0.6 fish was unusual and was attributed to the strong brood year in 1981.

KEY WORDS: Norton Sound, Kotzebue Sound, harvest, escapement, *Oncorhynchus tshawytscha*, *O. nerka*, *O. keta*, *O. kisutch*, *O. gorbuscha*, age-size-sex composition, fishery synopsis

INTRODUCTION

The Norton Sound, Port Clarence, and Kotzebue Sound commercial salmon management districts include all waters of Alaska from Canal Point Light, south of Stebbins, to Point Hope, north of Kotzebue. The Port Clarence District located within this area has been closed to commercial salmon fishing since 1966. The Norton Sound District is comprised of all waters of Alaska from Canal Point Light north to Cape Douglas (Figure 1). This district consists of six subdistricts: Nome (Subdistrict 1), Golovin (Subdistrict 2), Moses Point (Subdistrict 3), Norton Bay (Subdistrict 4), Shaktoolik (Subdistrict 5), and Unalakleet (Subdistrict 6). The Kotzebue Sound District includes all waters of Alaska from Point Hope to Cape Prince of Wales, but commercial salmon fishing is restricted to Subdistricts 1 and 2, consisting of ocean waters north of the Baldwin Peninsula (Figures 2 and 3). Subdistrict 2 normally remains closed unless a chum salmon return substantially above average warrants opening this area at the mouth of the Noatak River.

Five species of Pacific salmon are found in the Norton and Kotzebue Sound areas. They are, in descending order of economic importance (average ex-vessel value), chum salmon (*Oncorhynchus keta*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), and sockeye salmon (*O. nerka*). Numerically, the even-year returns of pink salmon are the largest of the five species followed by chum, coho, chinook, and sockeye salmon.

Knowledge of the magnitude, distribution, timing, and age-sex-size composition of both the harvest and escapement by stock is fundamental to managing salmon fisheries and achieving full production; i.e., salmon recruitment is directly related to the number of fish in each age, sex, and size category of the spawning population (escapement). Therefore, the age, sex, and size composition for selected harvests and escapements in the Norton and Kotzebue Sound areas have been estimated annually since 1962 and are presented in this report for 1988.

Basic fishery statistics for the Norton Sound-Kotzebue Sound Area are available from several additional sources. Commercial and subsistence harvest and spawning escapement data for the years 1961 to 1988 are available from ADF&G (1989). In addition, the results from escapement assessment projects are analyzed and reported annually. For the 1988 season these included test fishery projects on the Unalakleet River (Lean 1989a) and Noatak River (Kneupfer 1989) and a counting tower project on the Kwiniuk River (Lean 1989b). Age, sex, and size data for Norton Sound and Kotzebue Sound from 1962 to 1982 are summarized in an unpublished report series entitled ADF&G Arctic-Yukon-Kuskokwim Region Age-Sex-Size Composition of Salmon. Beginning with the 1983 season, these data have been published in an annual report (Lean et. al. 1984; Bigler and Lean 1986; Hamner 1987, 1989a, 1989b).

METHODS

Harvest and Escapement

Commercial catch data presented in this report were compiled from harvest receipts (fish tickets) which document each sale by a licensed fisherman. These data were summarized by microcomputer in the Nome area office and the Kotzebue seasonal office during the commercial fishing season.

Subsistence catches have not been monitored as closely as commercial catches in the Norton Sound-Kotzebue Sound Area. Due to budget constraints, no subsistence harvest surveys were conducted in the Norton Sound area in 1988. A subsistence permit is required to subsistence fish in the Nome Subdistrict and catch limits are set by permit for each river and species. In the Kotzebue area household interviews were conducted in several villages. The members of each household were asked how many fish of each species were caught for subsistence use. During these surveys it was assumed that fishermen could accurately recall their harvests, which may have occurred over several weeks. The reported subsistence harvests are estimates of total catch for each village surveyed. A mean catch per fishing family was calculated for each village surveyed. This mean was applied to those families known to have fished but unavailable for interview.

Aerial surveys have been the primary method for monitoring salmon escapement in the Norton Sound and Kotzebue Sound drainages. They have not provided a total enumeration of salmon spawning abundance. Ideally, a series of these surveys are conducted on approximately the same dates under similar survey conditions, and can be compared across years. Therefore, aerial survey escapement counts should be regarded as an index of relative abundance for the surveyed streams. Test fishing catches provide an index of escapement and species composition for turbid or large drainages that are difficult to monitor visually. Test fishery catch and catch per unit of effort (CPUE) statistics are used as an index of relative abundance. Counting towers provide a better estimate of escapement. Test fisheries and counting towers both provide data on migratory timing. In 1988 a counting tower on the Kwiniuk River in the Moses Point Subdistrict and test fishing projects on the Unalakleet River in the Unalakleet Subdistrict and the Noatak River in the Kotzebue District were used to monitor escapements.

Age, Sex, and Length Data Collection

Age was determined from scales removed from the left side of the fish in an area above the lateral line and crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Scales were mounted on gum cards and impressions made in cellulose acetate. Ages were reported in European notation (the first digit refers to the freshwater age and does not include the year spent in the gravel; the second digit refers to the ocean age). Sex was determined by examining external morphology (snout, vent, body symmetry),

extruded eggs, ovipositor or milt of live fish. The sex of dead fish was determined by examining the gonads, if necessary. Fish length from mid-eye to fork-of-tail was measured to the nearest millimeter.

In some cases sex and length data were obtained without ageable scales, while in other cases ageable scales were collected without the corresponding sex or length data. Therefore, numbers of fish in a length-by-age summary table may differ from numbers of fish in a sex-by-age summary table for a given fishery or escapement sample. Additionally, the total number of fish in an age category for a sample may be greater than the sum of females and males for that category.

Sample Size

Minimum sample size goals within temporal strata were derived for each species of interest (L. K. Brannian, Alaska Department of Fish and Game, Anchorage, personal communication). The objective was to obtain an estimated proportion by age class that was within 5 percentage points of the true proportion 90% of the time. This resulted in a per strata sample size goal for readable scales of 502 fish for species with three major age classes (chinook salmon), 450 fish for species with two major age classes (chum salmon), and 247 fish for species with one major age class (coho salmon). Minor age classes comprising <10% of the return were pooled and treated as a single age class in this analysis. Actual collection goals required that sample sizes be increased to include an expected proportion of unreadable scales. In cases where the total number of readable samples collected was less than the goal, data from several strata were pooled, and a standard error of the mean was calculated.

RESULTS

Commercial fishery samples were collected in sufficient numbers to estimate age and sex composition of the harvest for chinook, chum, and coho salmon in the Unalakleet Subdistrict of Norton Sound and for chum salmon in the Kotzebue District. Additional commercial fishery samples were collected in small numbers from chinook salmon catches in the Shaktoolik Subdistrict and from chum salmon catches in the Moses Point Subdistrict of Norton Sound. Chinook, chum, and coho salmon were sampled from the Unalakleet River set gill net test fishing catch, while chum salmon were sampled from the Noatak River drift gill net test fishing catch. Due to the selectivity of the 149 mm (5-7/8 in) stretched-mesh gill nets used on these two projects, the sample compositions are not an unbiased estimator of spawning escapement age, sex, and size composition. Kotzebue Sound chum salmon escapement samples were collected from the Noatak River spawning grounds by beach seine, and by carcass collection from the Squirrel River and Salmon River spawning grounds in the Kobuk River drainage.

Comparisons of age, sex, and size composition were not substantiated by statistical testing.

Norton Sound

Commercial and Subsistence Harvest

The 1988 Norton Sound commercial harvest totaled 225,165 salmon and was comprised of 4,096 chinook, 107,996 chum, 74,604 pink, 1,252 sockeye, and 37,247 coho salmon (Table 1; Appendix A). Although Norton Sound consists of six subdistricts, salmon are primarily harvested in the Unalakleet (34%), Golovin (30%), Moses Point (16%), and Shaktoolik (14%) Subdistricts.

The chinook salmon harvest was 60% below the 1983-87 average and comprised 2% of the district's total salmon harvest. The majority (71%) of the catch was taken in the Unalakleet and Shaktoolik Subdistricts. Most fishermen in the Unalakleet and Shaktoolik Subdistricts target on chinook salmon from the opening of the season in mid-June to the end of June using set gill nets with 210 mm (8-1/4 in) stretched mesh. During this portion of the season, fishing periods in these two subdistricts are reduced to 24 h from the normal 48 h to provide for adequate chinook escapements. North of Shaktoolik Subdistrict, fishermen typically use 149 mm (5-7/8 in) mesh gill nets throughout the fishing season and target on chum salmon, with chinook salmon harvested incidentally.

Chum salmon, the most economically important (ex-vessel value) species in Norton Sound, comprised 48% of the district's total harvest in 1988. The 1988 harvest was 37% below the 1983-87 average. Golovin fishermen landed 31% of the district's chum catch, followed by Unalakleet (23%) and Shaktoolik (20%) fishermen.

Pink salmon returns in Norton Sound follow an even-year cycle of high abundance. The 1988 harvest was 53% above the 1983-87 average, but 48% below the 1978-87 average, which includes an equal number of even and odd numbered years. Special fishing periods were scheduled to direct harvest on pink salmon in all but the Nome Subdistrict. During these special periods gill nets were restricted to a maximum mesh size of of 102 mm (4 in) stretch measure. Pink salmon comprised 33% of the district's total salmon harvest, with the majority taken in the Golovin (42%) and Unalakleet (32%) Subdistricts.

Sockeye salmon are harvested in small numbers incidental to chum and pink salmon. A record 1,252 sockeye were harvested in 1988, with 74% of the total taken in the Golovin Subdistrict.

The coho salmon harvest was the fourth largest on record but was 7% below the 1983-87 average and accounted for 17% of the district's total salmon catch. Fishermen in the Unalakleet Subdistrict harvested 65% of the catch, followed by Shaktoolik fishermen with 16%.

Although many of the 13,000 residents of the Norton Sound area are dependent to varying degrees on the fish and game resources of the area, subsistence catches have not been monitored since 1983, except in the Nome Subdistrict. Prior to 1983 the department conducted annual household surveys in many of the villages in the area. For the last 5 years in which complete surveys were conducted (1978-82), the average subsistence catch in the Norton Sound area was 73,000 salmon of all

species combined; since not all fishermen were contacted, this should be considered a minimum estimate. In the Nome Subdistrict, subsistence permits require that fishermen document their harvest by species. One-hundred and seventy-seven subsistence permits were issued in 1988. One-hundred and three of these were fished and resulted in a harvest of 9,419 salmon: 63 chinook, 5,952 chum, 2,159 pink, 169 sockeye, and 1,076 coho salmon (Table 2).

Escapement Abundance

Salmon escapements were primarily assessed by aerial survey (Table 3), and survey conditions were generally better than usual in 1988. Chinook salmon escapement index counts were above average in the Unalakleet River (1,234) and below average in the Shaktoolik River (410), the two largest producers of chinook in Norton Sound. Chum salmon escapement indices were above average in the Shaktoolik River (13,242), near average for the Norton Bay Subdistrict (5,100 for the Inglutalik River and 1,770 for the Ungalik River), and below average in the other subdistricts. Pink salmon escapement indices were average to excellent for all subdistricts (192,135 for the Shaktoolik River, 174,541 for the Kwiniuk River counting tower, 148,170 for the Unalakleet River) with the exception of the Nome Subdistrict. Sockeye occur in small numbers and escapements are not monitored on a regular basis. Coho salmon escapements appeared to be very good (1,280 for the Nome River, 1,129 for the Unalakleet River, and 1,124 for the Shaktoolik River), although incomplete historic information on coho escapements limits interpretation of results.

Age, Sex, and Length Composition

Chinook salmon commercial harvest in the Unalakleet Subdistrict was 56.7% age-1.4 and 30.2% age-1.3, with ages 1.2 and 1.5 contributing small percentages (Table 4). Females were estimated to contribute 46.0% to the harvest. A small sample from the Shaktoolik commercial harvest was also dominated by ages 1.4 and 1.3 (Table 5). A sample of 14 chinook salmon from the Unalakleet River test fishery using 149 mm (5-7/8 in) mesh gill nets was 57.1% age 1.3 and 35.7% age 1.2, and nearly all were males (Table 5). Mean lengths by age group for all samples collected ranged from 577 mm for age 1.2 males to 997 mm for an age-1.5 male, both from the Shaktoolik commercial fishery sample (Table 6).

The chum salmon commercial harvest in the Unalakleet Subdistrict was 60.5% age 0.3 and 36.8% age 0.4, with ages 0.2 and 0.5 contributing small percentages (Table 7). Females were estimated to contribute 46.3% to the harvest. A small sample from the Moses Point commercial harvest was also dominated by ages 0.3 and 0.4 (Table 8). A sample of 483 chum salmon from the Unalakleet River test fishery using 149 mm (5-7/8 in) mesh gill nets was 58.0% age 0.3 and 38.1% age 0.4, and 40.4% female (Table 8). One age-0.6 fish was found in the Moses Point commercial and Unalakleet River test fishery samples, an unusual age for this area. Mean lengths by age group for all samples collected ranged from 500 mm for an age-0.2 male to 655 mm for an age-0.6 male, both from the Moses Point commercial fishery sample (Table 9).

Coho salmon commercial harvest in the Unalakleet Subdistrict was 93.5% age 2.1 and 6.5% age 3.1, with age 1.1 not present in the sample (Table 10). Females were estimated to contribute 44.8% to the harvest. A sample of 141 coho salmon from the Unalakleet River test fishery using 149 mm (5-7/8 in) mesh gill nets was 92.9% age 2.1 and 7.1% age 3.1 and 41.8% female (Table 11). Mean lengths by age group for all samples collected ranged from 570 mm for age-2.1 males from the Unalakleet commercial catch sample, to 610 mm for age-3.1 males from the Unalakleet River test fishery sample (Table 12).

Kotzebue Sound

Commercial and Subsistence Harvest

The 1988 commercial harvest of salmon in the Kotzebue District totaled 352,915 chum salmon and 152 chinook salmon (Table 13). The harvest was 14% above the 1978-87 average of 310,400 fish (Appendix B). Due to an apparently early run, fishing time was extended from 24 h to 36 h per period on 25 July, 1 week earlier than normal. On 4 August fishing time was further extended to 48 h per period for two consecutive periods. The peak catch of 66,886 chum salmon occurred during the 8th period (8/4 to 8/6). Commercial fishing gear in the Kotzebue area consists of set gill nets of 140 mm (5-1/2 in) to 152 mm (6 in) stretched mesh and up to 274 m (150 fm) in aggregate length per fisherman.

Door-to-door subsistence fishermen interviews were conducted in two Kobuk River villages, Shungnak and Noorvik, during the last 2 weeks of September (Table 14). Fishermen from both villages reported better than average catches. The average catch per fishing family in Noorvik was 300 chum salmon compared to the 1983-87 average of 234 fish. Shungnak fishermen reported a catch average of 389 chum salmon per fishing family compared to the 1983-87 average of 255 fish. Total chum salmon harvest estimates for the two villages were 7,500 for Noorvik and 6,223 for Shungnak.

Escapement Abundance

Aerial surveys of index spawning areas in 1988 were hindered by poor weather (Table 15). Surveys were conducted before and after peak spawning on the lower Kobuk streams, after peak spawning on the upper Kobuk, and during peak spawning on the Noatak River. Considering survey conditions and timing, it appears that escapements were nearly average for all streams, except the Squirrel River, which was below average. Chum salmon escapement index counts were 45,930 for the Noatak River, 4,848 for the Squirrel River, 6,208 for the Salmon River, 3,122 for the Tutuksuk River, and 11,895 for the upper Kobuk River.

Age, Sex, and Length Composition

Sufficient commercial fishery catch samples were collected to stratify the season into seven sample periods. Age-0.3 predominated throughout the season, while age-

0.5 tended to decrease and age-0.2 tended to increase as the season progressed. The chum salmon commercial harvest for the entire season was comprised of 74.7% age 0.3, 17.2% age 0.4, 6.1% age 0.2, 1.9% age 0.5, and 0.1% age 0.6 (Table 16). The occurence of age-0.6 fish was unusual for this area, and was attributed to the strong 1981 brood year. Females were estimated to contribute 52.2% to the harvest. During the prior 10 year period (1978-87), age 0.3 averaged 57.0% and age 0.4 averaged 30.6% of the commercial harvest in the Kotzebue District (Appendix B).

Additional samples were collected from the test fishery located in the lower Noatak River using 149 mm (5-7/8 in) mesh gill nets (age data only), and from the Noatak, Squirrel, and Salmon River spawning grounds. Age 0.3 accounted for 66.6% to 85.0% and females accounted for 58.1% to 61.3% of these escapement samples (Table 17).

Mean length by age group for all samples collected ranged from 531 mm for age-0.2 females from the Squirrel River escapement carcass sample to 695 mm for an age-0.6 male from the Noatak River escapement beach seine sample (Table 18).

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1989. Norton Sound-Port Clarence-Kotzebue Sound annual management report, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3N89-10, Anchorage.

Bigler, B. S., and C. F. Lean. 1986. Age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 172, Juneau.

Hamner, H. H. 1987. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 193, Juneau.

Hamner, H. H. 1989a. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1986. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report 89-08, Juneau.

Hamner, H. H. 1989b. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report 89-09, Juneau.

Kneupfer, G. 1989. Noatak River test fishing project, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3N89-15, Anchorage.

Lean, C. 1989a. Unalakleet River test net project, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3N89-14, Anchorage.

Lean, C. 1989b. Kwiniuk River salmon counting tower project, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3N89-11, Anchorage.

Lean, C. F., B. B. Bigler, and L. K. Brannian. 1984. Age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 130, Juneau.

Table 1. Norton Sound commercial salmon effort and catch (numbers) by subdistrict, 1988.

Subdistrict	Fisher-men	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho	Total
Nome	5	2	1,628	182	0	54	1,866
Golovin	21	108	33,348	31,559	921	2,149	68,085
Moses Point	36	663	18,585	13,703	93	3,974	37,018
Norton Bay	13	434	7,521	1,749	2	709	10,415
Shaktoolik	21	671	21,521	3,681	79	6,096	32,048
Unalakleet	69	2,218	25,363	23,730	157	24,265	75,733
District Totals	152[a]	4,096	107,966	74,604	1,252	37,247	225,165

[a] Total fishermen is total number of fishing permits used during the 1988 season in Norton Sound.

Table 2. Subsistence salmon effort and catch in Nome, Norton Sound Subdistrict 1, 1988.

Location	Permits Issued	Permits Returned	Permits Used	Catch (nos.)[a] Chinook	Chum	Pink	Sockeye	Coho	Total
Nome R.	21	21	10	0	46	90	4	150	290
Marine Waters	93	84	60	60	4,395	1,043	159	491	6,148
Sinuk R.	4	4	1	0	57	11	4	0	72
Eldorado R.	23	18	15	3	1,227	544	0	175	1,949
Flambeau R.	8	8	2	0	81	4	0	71	156
Snake R.	13	12	7	0	43	158	2	110	313
Solomon R.	6	5	3	0	17	74	0	9	100
Bonanza R.	7	5	4	0	67	223	0	4	294
Cripple R.	2	2	1	0	19	12	0	66	97
Totals	177	159	103	63	5,952	2,159	169	1,076	9,419

[a] Harvested by beach seine or set gill net.

Table 3. Salmon aerial survey escapement counts in Norton Sound in 1988 by species and index escapement goals for chum salmon.

Subdistrict	Stream	Chinook	Chum		Pink	Coho[b]
			Goal[a]	Count		
Nome (1)	Nome	3	2,000	973[c]	2,490	1,280[d]
	Flambeau	3	3,300	765	10	
	Eldorado	17	5,300	2,645	1,045	78
	Sinuk	3		2,070[c]	4,652	563
	Solomon	0		25	570	
Golovin (2)	Fish	36	17,500	1,240[c]	29,950	
	Niukluk	18	8,000	6,501	8,160	1,095[e]
	Boston	163	2,500	1,040[c]	7,400	
Moses Pt. (3)	Kwiniuk[f]		232	25,000	12,686	174,541
444						
	Tubutulik	561	12,000	4,660[c]	114,150	
Norton Bay (4)	Inglutalik	788		5,100	10,740	
	Ungalik	53		1,770[c]	99,600	358
Shaktoolik (5)	Shaktoolik	410	11,000	13,242[c]	192,135	1,124
Unalakleet (6)	Unalakleet System[g]	1,234		1,620[c]	148,170	1,129
	North River	202	4,500	30[c]	112,770	240

[a] Index escapement goals have only been developed for chum salmon and are based on the average of historical peak aerial survey counts with "good" or "fair" ratings.

[b] Most coho surveys flown under poor conditions.

[c] Species identification difficult between chum and pink salmon due to the relative abundance of pink salmon. Chum salmon counts may be low and pink salmon count may include some chum salmon.

[d] Peak coho salmon count obtained by adding upper river boat survey count on 9/01 to lower river aerial survey count on 9/02.

[e] Includes 474 coho salmon counted in Ophir Creek.

[f] Preliminary expanded tower counts, except for coho aerial survey count. Chum salmon escapement goal for Kwiniuk River is based on historical tower count data.

[g] Includes Old Woman River aerial survey counts.

Table 4. Chinook salmon commercial catch by age and sex in Unalakleet, Norton Sound Subdistrict 6, 1988.

		Brood Year and Age Group				
		1984	1983	1982	1981	
		1.2	1.3	1.4	1.5	Total
Stratum Dates:	6/20-9/07					
Sample Dates:	6/21-7/27					
Sample Size:	298					
Female	Percent	0.3	5.4	36.2	4.0	46.0
	Catch	7	119	804	89	1,020
Male	Percent	7.4	24.8	20.5	1.3	54.0
	Catch	164	551	454	30	1,198
Total	Percent	7.7	30.2	56.7	5.4	100.0
	Catch	171	670	1,258	119	2,218
	Std Error	34	59	64	29	

Table 5. Age and sex composition of chinook salmon samples from Norton Sound commercial and test fisheries, 1988.

		Brood Year and Age Group				
		1984	1983	1982	1981	
		1.2	1.3	1.4	1.5	Total
Shaktoolik (Subdistrict 5) Commercial GN Sample Dates: 6/21-6/24						
Female	Sample Size	0	2	23	2	27
	Percent	0.0	2.8	32.4	2.8	38.0
Male	Sample Size	9	25	8	1	43
	Percent	12.7	35.2	11.3	1.4	60.6
Total	Sample Size	9	28	31	3	71
	Percent	12.7	39.4	43.7	4.2	100.0
	Std Error	4.0	5.8	5.9	2.4	
Unalakleet River Test GN[a] Sample Dates: 6/20-8/01						
Female	Sample Size	0	1	0	0	1
	Percent	0.0	7.1	0.0	0.0	7.1
Male	Sample Size	5	7	1	0	13
	Percent	35.7	50.0	7.1	0.0	92.9
Total	Sample Size	5	8	1	0	14
	Percent	35.7	57.1	7.1	0.0	100.0
	Std Error	13.3	13.7	7.1	0.0	

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 6. Mean length (mm) by age and sex for chinook salmon samples from Norton Sound commercial and test fisheries, 1988.

		Brood Year and Age Group			
		1984	1983	1982	1981
		1.2	1.3	1.4	1.5
Shaktoolik (Subdistrict 5) Commercial GN Sample Dates: 6/21-6/24					
Female	Mean Length	-	799	858	891
	Std. Error	-	24.0	9.8	43.0
	Sample Size	0	2	23	2
Male	Mean Length	577	701	820	997
	Std. Error	11.4	17.6	20.8	0.0
	Sample Size	9	25	8	1
Unalakleet (Subdistrict 6) Commercial GN Sample Dates: 6/21-7/27					
Female	Mean Length	635	775	853	928
	Std. Error	0.0	19.5	5.4	21.1
	Sample Size	1	16	108	12
Male	Mean Length	592	698	820	918
	Std. Error	12.3	9.8	12.6	14.8
	Sample Size	22	74	61	4
Unalakleet River Test GN[a] Sample Dates: 6/20-8/01					
Female	Mean Length	-	815	-	-
	Std. Error	-	0.0	-	-
	Sample Size	0	1	0	0
Male	Mean Length	647	771	821	-
	Std. Error	32.1	37.6	0.0	-
	Sample Size	5	7	1	0

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 7. Chum salmon commercial catch by age and sex in Unalakleet, Norton Sound Subdistrict 6, 1988.

		Brood Year and Age Group				
		1985	1984	1983	1982	
		0.2	0.3	0.4	0.5	Total
Stratum Dates:	6/20-9/07					
Sample Dates:	6/28-8/06					
Sample Size:	1,506					
Female	Percent	0.2	25.7	19.3	1.2	46.3
	Catch	51	6,518	4,884	303	11,755
Male	Percent	0.4	34.8	17.5	0.9	53.7
	Catch	101	8,825	4,446	236	13,608
Total	Percent	0.6	60.5	36.8	2.1	100.0
	Catch	152	15,342	9,330	539	25,363
	Std Error	50	320	315	94	

Table 8. Age and sex composition of chum salmon samples from Norton Sound commercial and test fisheries, 1988.

		Brood Year and Age Group					
		1985	1984	1983	1982	1981	
		0.2	0.3	0.4	0.5	0.6	Total
Moses Point (Subdistrict 3) Commercial GN Sample Dates: 6/22-7/08							
Female	Sample Size	0	23	11	0	0	34
	Percent	0.0	27.1	12.9	0.0	0.0	40.0
Male	Sample Size	1	32	13	1	1	48
	Percent	1.2	37.6	15.3	1.2	1.2	56.5
Total	Sample Size	1	58	24	1	1	85
	Percent	1.2	68.2	28.2	1.2	1.2	100.0
	Std Error	1.2	5.1	4.9	1.2	1.2	
Unalakleet River Test GN[a] Sample Dates: 6/07-9/09							
Female	Sample Size	0	125	65	5	0	195
	Percent	0.0	25.9	13.5	1.0	0.0	40.4
Male	Sample Size	6	152	116	5	0	279
	Percent	1.2	31.5	24.0	1.0	0.0	57.8
Total	Sample Size	7	280	184	11	1	483
	Percent	1.4	58.0	38.1	2.3	0.2	100.0
	Std Error	0.5	2.2	2.2	0.7	0.2	

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 9. Mean length (mm) by age and sex for chum salmon samples from Norton Sound commercial and test fisheries, 1988.

		Brood Year and Age Group				
		1985	1984	1983	1982	1981
		0.2	0.3	0.4	0.5	0.6
Moses Point (Subdistrict 3) Commercial GN Sample Dates: 6/22-7/08						
Female	Mean Length	-	561	572	-	-
	Std. Error	-	5.0	6.9	-	-
	Sample Size	0	23	11	0	0
Male	Mean Length	500	584	603	610	655
	Std. Error	0.0	4.3	6.7	0.0	0.0
	Sample Size	1	32	13	1	1
Unalakleet (Subdistrict 6) Commercial GN Sample Dates: 6/28-8/06						
Female	Mean Length	558	577	586	599	-
	Std. Error	17.8	1.1	1.4	7.6	-
	Sample Size	3	387	290	18	0
Male	Mean Length	548	596	613	613	-
	Std. Error	10.3	1.0	1.8	8.1	-
	Sample Size	6	524	264	14	0
Unalakleet River Test GN[a] Sample Dates: 6/07-9/09						
Female	Mean Length	-	584	600	596	-
	Std. Error	-	2.0	3.1	9.6	-
	Sample Size	0	125	65	5	0
Male	Mean Length	574	600	619	613	-
	Std. Error	11.1	2.4	2.7	14.2	-
	Sample Size	6	152	116	5	0

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 10. Coho salmon commercial catch by age and sex in Unalakleet, Norton Sound Subdistrict 6, 1988.

		Brood Year and Age Group		
		1984	1983	
		2.1	3.1	Total
Stratum Dates:	7/11-9/07			
Sample Dates:	7/29-8/13			
Sample Size:	248			
Female	Percent	41.5	3.2	44.8
	Catch	10,078	783	10,861
Male	Percent	52.0	3.2	55.2
	Catch	12,622	783	13,404
Total	Percent	93.5	6.5	100.0
	Catch	22,700	1,565	24,265
	Std Error	379	379	

Table 11. Age and sex composition of coho salmon samples from Norton Sound test fishery, 1988.

		Brood Year and Age Group		
		1984	1983	
		2.1	3.1	Total
Unalakleet River Test GN[a] Sample Dates: 7/28-9/10				
Female	Sample Size	55	4	59
	Percent	39.0	2.8	41.8
Male	Sample Size	76	6	82
	Percent	53.9	4.3	58.2
Total	Sample Size	131	10	141
	Percent	92.9	7.1	100.0
	Std Error	2.2	2.2	

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 12. Mean length (mm) by age and sex for coho salmon samples from Norton Sound commercial and test fisheries, 1988.

		Brood Year and Age Group	
		1984	1983
		2.1	3.1
Unalakleet (Subdistrict 6) Commercial GN Sample Dates: 7/29-8/13			
Female	Mean Length	575	585
	Std. Error	2.8	2.4
	Sample Size	103	8
Male	Mean Length	570	592
	Std. Error	3.8	13.3
	Sample Size	129	8
Unalakleet River Test GN[a] Sample Dates: 7/28-9/10			
Female	Mean Length	591	596
	Std. Error	3.5	3.4
	Sample Size	55	4
Male	Mean Length	586	610
	Std. Error	3.4	12.2
	Sample Size	76	6

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 13. Kotzebue District commercial salmon set gill net effort and catch by fishing period, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum
1	7/11-7/12	24	76	11	5,630
2	7/14-7/15	24	118	28	13,146
3	7/18-7/19	24	141	15	19,914
4	7/21-7/22	24	146	14	30,284
5	7/25-7/26	36	147	10	27,214
6	7/28-7/29	36	160	18	43,464
7	8/01-8/02	36	166	6	30,794
8	8/04-8/06	48	175	18	66,886
9	8/08-8/10	48	165	10	32,989
10	8/12-8/13	36	150	9	44,506
11	8/15-8/16	36	134	6	15,007
12	8/18-8/19	36	124	5	12,174
13	8/22-8/23	36	92	1	6,223
14	8/25-8/26	36	58	1	2,886
15	8/29-8/30	36	36	0	1,798
Season Total		516	193[a]	152	352,915

[a] Total fishermen is total number of fishing permits used during the 1988 season in Kotzebue District.

Table 14. Subsistence salmon effort and catch in Noorvik and Shungnak, Kotzebue District, 1988.

Village	Number of Fishermen	Chum Salmon Harvest	Average Catch per Fisherman
Noorvik	25	7,500	300
Shungnak	16	6,223	389
Survey Total[a]	41	13,723	335

[a] Subsistence catch estimated by direct interview of available fishermen in two villages. Resulting estimates were expanded for subsistence fishermen not contacted. Salmon were harvested for subsistence in several other villages in the area. These were not surveyed due to budget and staff limitations.

Table 15. Chum salmon aerial survey escapement counts and index escapement goals for Kotzebue Sound streams, 1988.

River	Index Escapement Goal[a]	Aerial Survey Count
Noatak	80,000	45,930[b]
Squirrel	11,500	4,848[b]
Salmon	7,000	6,208
Tutuksuk	2,000	3,122
Upper Kobuk R. (between Kobuk and the lower canyon)	10,000	11,895[b]

[a] Index escapement goals are based on the average of historical peak aerial survey counts with "good" or "fair" ratings.
[b] Poor survey rating due to survey conditions or timing.

Table 16. Chum salmon commercial catch by age and sex in Kotzebue District by sample period, 1988.

		Brood Year and Age Group					
		1985	1984	1983	1982	1981	
		0.2	0.3	0.4	0.5	0.6	Total
Stratum Dates:	7/11-7/15						
Sample Dates:	7/12-7/15						
Sample Size:	441						
Female	Percent	0.0	24.3	10.0	0.9	0.0	35.1
	Catch	0	4,556	1,873	170	0	6,599
Male	Percent	0.5	47.8	15.4	1.1	0.0	64.9
	Catch	85	8,984	2,895	213	0	12,177
Total	Percent	0.5	72.1	25.4	2.0	0.0	100.0
	Catch	85	13,539	4,769	383	0	18,776
	Std Error	60	401	390	127	0	
Stratum Dates:	7/18-7/22						
Sample Dates:	7/18-7/22						
Sample Size:	444						
Female	Percent	0.2	30.6	8.8	2.5	0.2	42.3
	Catch	113	15,376	4,409	1,244	113	21,255
Male	Percent	1.1	48.0	7.9	0.5	0.2	57.7
	Catch	565	24,081	3,957	226	113	28,943
Total	Percent	1.4	78.6	16.7	2.9	0.5	100.0
	Catch	678	39,457	8,366	1,470	226	50,198
	Std Error	275	978	889	402	160	
Stratum Dates:	7/25-7/29						
Sample Dates:	7/26-7/29						
Sample Size:	439						
Female	Percent	0.5	35.1	9.3	0.5	0.0	45.3
	Catch	322	24,794	6,601	322	0	32,039
Male	Percent	2.7	39.6	11.6	0.7	0.0	54.7
	Catch	1,932	28,014	8,211	483	0	38,639
Total	Percent	3.2	74.7	21.0	1.1	0.0	100.0
	Catch	2,254	52,807	14,812	805	0	70,678
	Std Error	593	1,468	1,374	358	0	

- Continued -

Table 16. (page 2 of 3)

		Brood Year and Age Group					
		1985	1984	1983	1982	1981	
		0.2	0.3	0.4	0.5	0.6	Total
Stratum Dates:	8/01-8/06						
Sample Dates:	8/01-8/06						
Sample Size:	441						
Female	Percent	0.7	42.9	11.1	1.1	0.0	55.8
	Catch	664	41,863	10,853	1,107	0	54,488
Male	Percent	3.9	33.6	5.9	0.9	0.0	44.2
	Catch	3,765	32,781	5,759	886	0	43,192
Total	Percent	4.5	76.4	17.0	2.0	0.0	100.0
	Catch	4,430	74,644	16,612	1,993	0	97,680
	Std Error	969	1,977	1,749	658	0	
Stratum Dates:	8/08-8/13						
Sample Dates:	8/09-8/13						
Sample Size:	442						
Female	Percent	3.4	47.1	7.9	0.5	0.0	58.8
	Catch	2,630	36,468	6,136	351	0	45,585
Male	Percent	7.2	27.1	5.2	1.6	0.0	41.2
	Catch	5,610	21,039	4,033	1,227	0	31,910
Total	Percent	10.6	74.2	13.1	2.0	0.0	100.0
	Catch	8,240	57,508	10,169	1,578	0	77,495
	Std Error	1,138	1,614	1,246	521	0	
Stratum Dates:	8/15-8/19						
Sample Dates:	8/16-8/19						
Sample Size:	448						
Female	Percent	6.5	47.3	9.8	1.1	0.0	64.7
	Catch	1,759	12,862	2,670	303	0	17,595
Male	Percent	9.2	21.4	4.2	0.4	0.0	35.3
	Catch	2,488	5,825	1,153	121	0	9,586
Total	Percent	15.6	68.8	14.1	1.6	0.0	100.0
	Catch	4,247	18,687	3,822	425	0	27,181
	Std Error	467	596	447	159	0	

- Continued -

Table 16. (page 3 of 3)

		Brood Year and Age Group					
		1985	1984	1983	1982	1981	
		0.2	0.3	0.4	0.5	0.6	Total
Stratum Dates:	8/22-8/30						
Sample Dates:	8/22-8/30						
Sample Size:	669						
Female	Percent	5.5	40.5	13.8	0.9	0.1	60.8
	Catch	603	4,418	1,500	98	16	6,635
Male	Percent	8.7	22.9	6.9	0.6	0.1	39.2
	Catch	946	2,494	750	65	16	4,272
Total	Percent	14.2	63.4	20.6	1.5	0.3	100.0
	Catch	1,549	6,913	2,250	163	33	10,907
	Std Error	147	203	171	51	23	
Entire Season Combined							
Sample Size:	3,324						
Female	Percent	1.7	39.8	9.6	1.0	0.0	52.2
	Catch	6,092	140,337	34,043	3,595	129	184,197
Male	Percent	4.4	34.9	7.6	0.9	0.0	47.8
	Catch	15,392	123,218	26,757	3,222	129	168,718
Total	Percent	6.1	74.7	17.2	1.9	0.1	100.0
	Catch	21,484	263,555	60,800	6,817	259	352,915
	Std Error	1,704	3,191	2,770	1,019	162	

Table 17. Age and sex composition of chum salmon samples from Kotzebue District test fishery and escapement, 1988.

		Brood Year and Age Group					
		1985	1984	1983	1982	1981	
		0.2	0.3	0.4	0.5	0.6	Total
Noatak River Test GN[a]							
Sample Dates: 7/19-8/25							
Total	Sample Size	145	906	187	20	2	1,260
	Percent	11.5	71.9	14.8	1.6	0.2	100.0
	Std Error	0.9	1.3	1.0	0.4	0.1	
Noatak River Escapement BS							
Sample Dates: 9/21-9/23							
Female	Sample Size	56	170	34	4	0	264
	Percent	12.6	38.4	7.7	0.9	0.0	59.6
Male	Sample Size	31	125	18	4	1	179
	Percent	7.0	28.2	4.1	0.9	0.2	40.4
Total	Sample Size	87	295	52	8	1	443
	Percent	19.6	66.6	11.7	1.8	0.2	100.0
	Std Error	1.9	2.2	1.5	0.6	0.2	
Squirrel River Escapement Carcasses							
Sample Dates: 9/03-9/05							
Female	Sample Size	7	167	30	3	0	207
	Percent	2.0	46.9	8.4	0.8	0.0	58.1
Male	Sample Size	5	100	8	1	0	114
	Percent	1.4	28.1	2.2	0.3	0.0	32.0
Total	Sample Size	13	298	41	4	0	356
	Percent	3.7	83.7	11.5	1.1	0.0	100.0
	Std Error	1.0	2.0	1.7	0.6	0.0	
Salmon River Escapement Carcasses							
Sample Dates: 9/06							
Female	Sample Size	7	78	11	2	0	98
	Percent	4.4	48.8	6.9	1.3	0.0	61.3
Male	Sample Size	1	58	3	0	0	62
	Percent	0.6	36.3	1.9	0.0	0.0	38.8
Total	Sample Size	8	136	14	2	0	160
	Percent	5.0	85.0	8.8	1.3	0.0	100.0
	Std Error	1.7	2.8	2.2	0.9	0.0	

[a] Gill net mesh size was 149 mm (5-7/8 in) stretch measure.

Table 18. Mean length (mm) by age and sex for chum salmon samples from Kotzebue District commercial fishery and escapement, 1988.

		Brood Year and Age Group				
		1985	1984	1983	1982	1981
		0.2	0.3	0.4	0.5	0.6
Kotzebue Commercial GN Sample Dates: 7/12-8/30						
Female	Mean Length	560	598	605	616	634
	Std. Error	2.2	0.6	1.4	5.4	3.5
	Sample Size	87	1,277	344	35	2
Male	Mean Length	573	625	633	628	642
	Std. Error	2.1	0.8	1.9	6.6	1.5
	Sample Size	167	1,113	268	27	2
Noatak River Escapement BS Sample Dates: 9/21-9/23						
Female	Mean Length	551	596	601	582	-
	Std. Error	2.9	2.2	5.8	15.1	-
	Sample Size	56	170	34	4	0
Male	Mean Length	582	635	648	662	695
	Std. Error	5.5	2.3	8.0	17.5	0.0
	Sample Size	31	125	18	4	1
Squirrel River Escapement Carcasses Sample Dates: 9/03-9/05						
Female	Mean Length	531	560	546	550	-
	Std. Error	5.5	2.3	5.6	5.8	-
	Sample Size	7	162	30	3	0
Male	Mean Length	553	603	602	670	-
	Std. Error	12.0	3.9	16.1	0.0	-
	Sample Size	5	100	8	1	0
Salmon River Escapement Carcasses Sample Dates: 9/06						
Female	Mean Length	544	558	551	558	-
	Std. Error	12.0	3.7	12.1	17.5	-
	Sample Size	7	78	11	2	0
Male	Mean Length	570	594	627	-	-
	Std. Error	0.0	3.5	1.7	-	-
	Sample Size	1	57	3	0	0

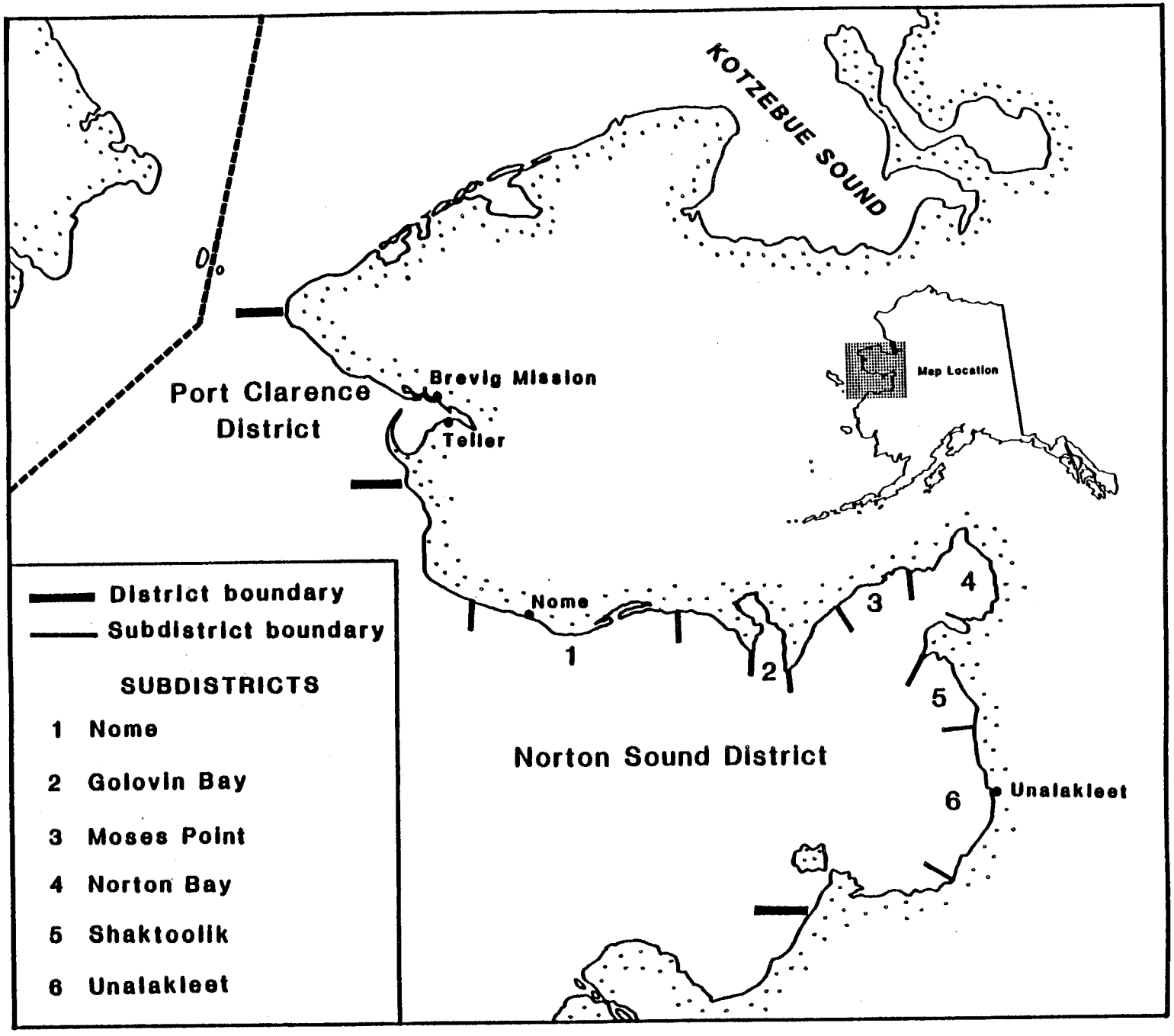

Figure 1. Norton Sound commercial salmon fishing subdistricts.

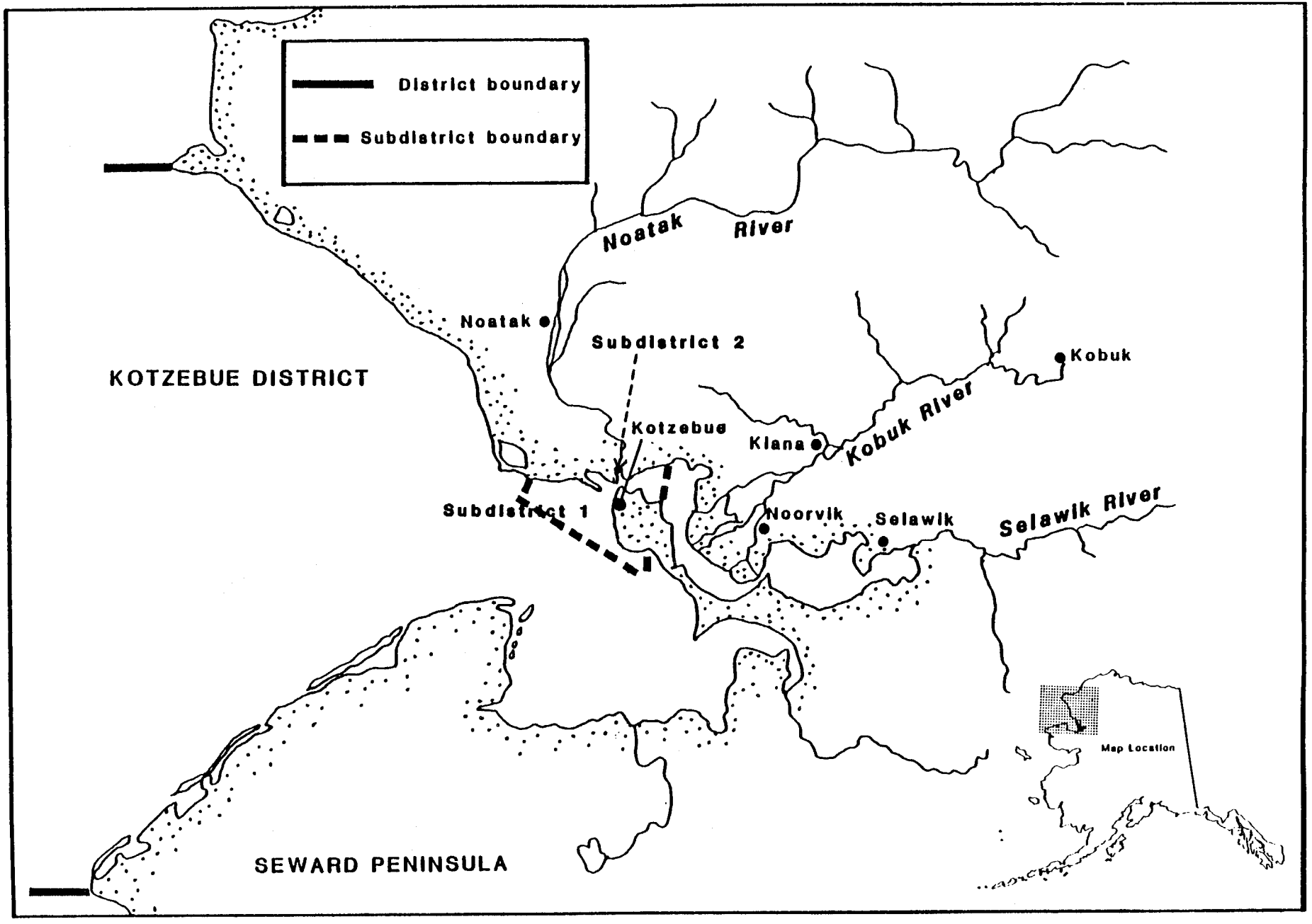

Figure 2. Kotzebue Sound commercial salmon fishing subdistricts.

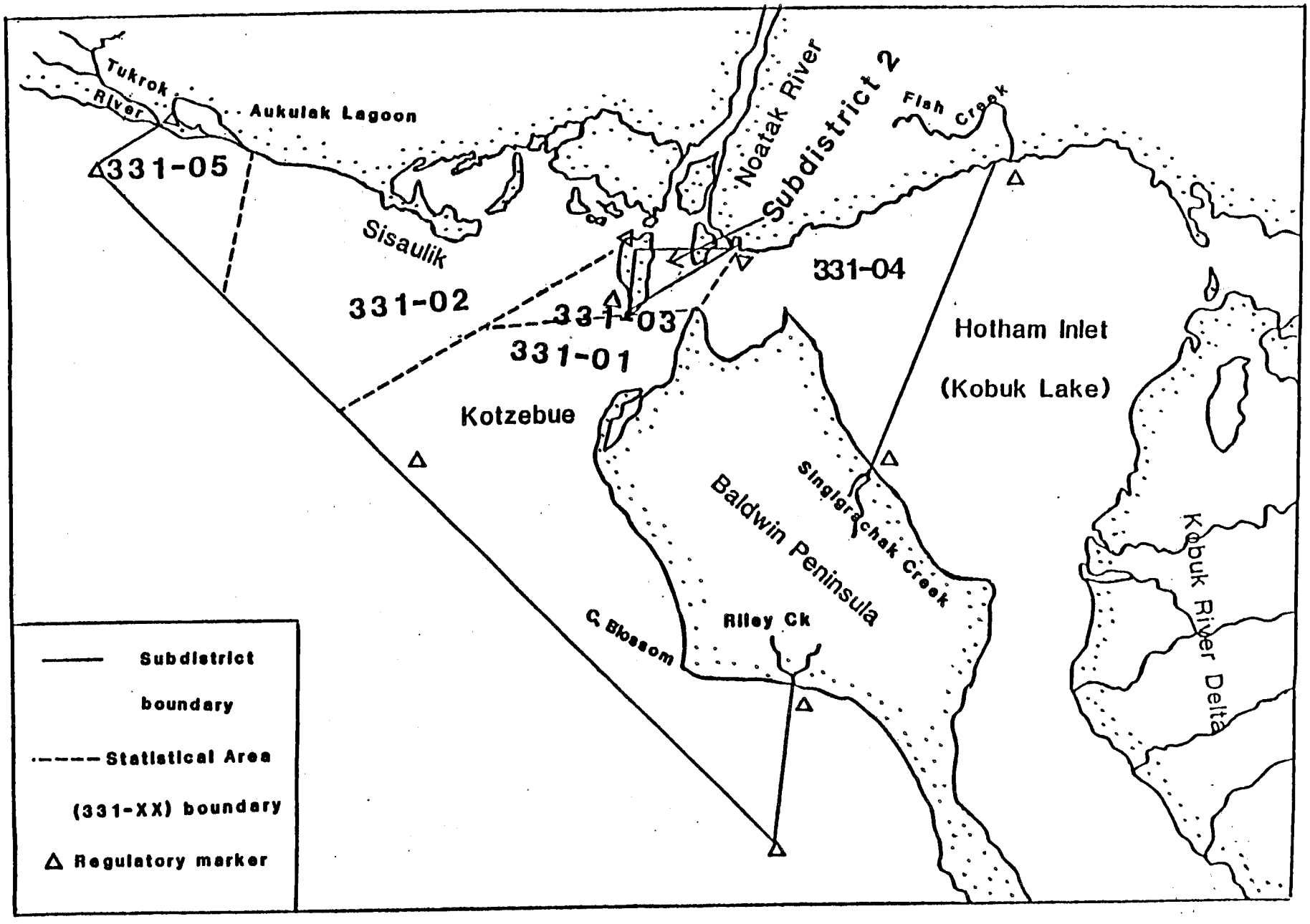

Figure 3. Kotzebue Sound commercial salmon fishing statistical areas.

(Page intentionally left blank)

APPPENDICES

(Page intentionally left blank)

Appendix A.1. Commercial salmon set gill net effort and catch in Nome, Norton Sound Subdistrict 1, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Coho
1	7/01-7/02	24	2	0	352	39	0
2	7/04-7/05	24	2	1	849	54	0
3	7/07-7/08	24	0				
4	7/11-7/12	24	3	0	333	77	0
5[a]	7/14-7/15	24	0				
6[a]	7/18-7/19	24	0				
7[a]	7/21-7/22	24	0				
8[a]	7/25-7/26	24	0				
9	7/28-7/29	24	2	1	94	12	5
10	8/01-8/02	24	0				
11	8/04-8/05	24	0				
12	8/08-8/09	24	0				
13	8/11-8/12	24	0				
14	8/15-8/16	24	0				
15	8/18-8/19	24	1	0	0	0	49
16	8/22-8/23	24	0				
17	8/25-8/26	24	0				
18	8/29-8/30	24	0				
Season Total		120[b]	5	2	1,628	182	54

[a] No buyers present.
[b] Total hours actually fished.

Appendix A.2. Commercial salmon set gill net effort and catch in Golovin, Norton Sound Subdistrict 2, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho
1	6/20-6/22	48	14	24	3,877	303	5	0
2	6/23-6/25	48	15	12	4,209	489	13	0
3	6/27-6/29	48	18	10	5,071	2,560	232	0
4	6/30-7/02	48	15	15	5,601	2,320	201	0
5[a]	7/03-7/04	24	10	1	665	2,486	15	0
6	7/04-7/06	48	19	7	4,599	2,157	156	0
7[a]	7/06-7/07	12	7	0	194	624	4	0
8	7/07-7/09	48	18	4	4,251	3,826	140	0
9[a]	7/10-7/11	24	7	0	345	1,497	16	0
10	7/11-7/13	48	17	3	1,974	2,692	75	0
11[a]	7/13-7/14	12	4	0	124	1,040	4	0
12[a]	7/15-7/16	48	9	0	371	4,563	2	0
13[a]	7/18-7/20	48	9	0	613	3,192	13	0
14[a]	7/21-7/23	48	8	0	352	1,069	9	3
15[a]	7/25-7/27	48	5	4	166	1,226	2	12
16[a]	7/28-7/30	48	7	4	190	1,192	9	30
17	8/01-8/03	48	10	2	313	240	7	257
18	8/04-8/06	48	8	8	159	83	6	334
19	8/08-8/10	48	10	7	119	0	4	600
20	8/11-8/13	48	7	4	90	0	3	361
21	8/15-8/17	48	5	1	13	0	0	225
22	8/18-8/20	48	8	2	52	0	5	327
23[b]	8/22-8/24	48	0					
24[b]	8/25-8/27	48	0					
25[b]	8/29-8/31	48	0					
Season Total		936[c]	21	108	33,348	31,559	921	2,149

[a] Special small mesh size fishing period directed at pink salmon.
[b] No buyers present.
[c] Total hours actually fished.

Appendix A.3. Commercial salmon set gill net effort and catch in Moses Point, Norton Sound Subdistrict 3, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho
1	6/20-6/22	48	21	165	3,086	163	0	0
2	6/23-6/25	48	24	218	3,282	482	0	0
3	6/27-6/29	48	27	156	3,955	1,660	0	0
4	6/30-7/02	48	23	47	1,708	1,286	15	0
5[a]	7/03-7/04	24	8	9	201	998	1	0
6	7/04-7/06	48	21	24	2,678	2,513	46	0
7[a]	7/06-7/07	12	9	1	132	965	0	0
8	7/07-7/09	48	22	18	1,598	2,184	14	0
9[a]	7/10-7/11	24	5	1	56	455	0	0
10	7/11-7/13	48	14	10	746	673	8	0
11[a]	7/13-7/14	12	1	0	9	40	0	0
12[a]	7/15-7/16	48	7	1	20	1,717	2	0
13[a]	7/18-7/20	48	7	0	168	364	1	0
14[a]	7/21-7/23	48	6	4	96	156	1	2
15[a]	7/25-7/27	48	0					
16[a]	7/28-7/30	48	3	2	108	37	3	14
17	8/01-8/03	48	9	2	175	9	2	133
18	8/04-8/06	48	15	3	116	1	0	276
19	8/08-8/10	48	21	1	270	0	0	748
20	8/11-8/13	48	17	0	14	0	0	972
21	8/15-8/17	48	19	0	50	0	0	978
22	8/18-8/20	48	19	1	117	0	0	774
23	8/22-8/24	48	1	0	0	0	0	77
24[b]	8/25-8/27	48	0					
25[b]	8/29-8/31	48	0					
Season Total		936[c]	36	663	18,585	13,703	93	3,974

[a] Special small mesh size fishing period directed at pink salmon.
[b] No buyers present.
[c] Total hours actually fished.

Appendix A.4. Commercial salmon set gill net effort and catch in Norton Bay, Norton Sound Subdistrict 4, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho
1	6/20-6/22	48	4	54	272	0	0	0
2	6/23-6/25	48	8	235	681	9	0	0
3	6/27-6/29	48	9	73	793	98	0	0
4	6/30-7/02	48	6	26	339	101	0	0
5[a]	7/03-7/04	24	0					
6	7/04-7/06	48	9	14	1,079	170	0	0
7[a]	7/06-7/07	12	0					
8	7/07-7/09	48	7	4	962	369	0	0
9[a]	7/10-7/11	24	0					
10	7/11-7/13	48	4	1	185	93	0	0
11[a]	7/13-7/14	12	0					
12	7/14-7/16	48	6	1	1,091	71	0	0
13	7/18-7/20	48	9	9	668	639	1	1
14	7/21-7/23	48	5	0	223	83	0	4
15	7/25-7/27	48	7	7	399	37	0	23
16	7/28-7/30	48	8	7	568	71	1	148
17	8/01-8/03	48	7	3	241	8	0	428
18	8/04-8/06	48	6	0	20	0	0	105
19[b]	8/08-8/10	48	0					
20[b]	8/11-8/13	48	0					
21[b]	8/15-8/17	48	0					
22[b]	8/18-8/20	48	0					
23[b]	8/22-8/24	48	0					
24[b]	8/25-8/27	48	0					
25[b]	8/29-8/31	48	0					
Season Total		672[c]	13	434	7,521	1,749	2	709

[a] Special small mesh size fishing period directed at pink salmon.
[b] No buyers present.
[c] Total hours actually fished.

Appendix A.5. Commercial salmon set gill net effort and catch in Shaktoolik, Norton Sound Subdistrict 5, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho
1	6/20-6/21	24	17	137	544	44	0	0
2	6/23-6/24	24	15	124	873	482	0	0
3	6/27-6/28	24	17	123	2,455	2,944	0	0
4	6/30-7/02	48	17	103	4,349	211	0	0
5[a]	7/03-7/04	24	0					
6	7/04-7/06	48	18	37	2,429	0	1	0
7[a]	7/06-7/07	12	0					
8	7/07-7/09	48	20	42	2,788	0	2	0
9[a]	7/10-7/11	24	0					
10	7/11-7/13	48	18	24	1,901	0	2	0
11[a]	7/13-7/14	12	0					
12	7/14-7/16	48	17	25	1,406	0	6	3
13	7/18-7/20	48	2	5	405	0	1	6
14	7/21-7/23	48	13	13	1,426	0	2	10
15	7/25-7/27	48	10	6	420	0	2	17
16	7/28-7/30	48	20	5	817	0	4	309
17	8/01-8/03	48	17	8	531	0	9	494
18	8/04-8/06	48	17	8	298	0	6	452
19	8/08-8/10	48	16	1	406	0	8	872
20	8/11-8/13	48	11	4	165	0	1	574
21	8/15-8/17	48	13	1	42	0	11	616
22	8/18-8/20	48	14	1	79	0	2	744
23	8/22-8/24	48	10	1	79	0	3	607
24	8/25-8/27	48	15	1	45	0	16	880
25	8/29-8/31	48	9	2	62	0	3	504
26[b]	9/01-9/03	48	0					
27[b]	9/05-9/07	48	0					
Season Total		1,008[c]	21	671	21,520	1,749	79	6,088

[a] Special small mesh size fishing period directed at pink salmon.
[b] No buyers present.
[c] Total hours actually fished.

Appendix A.6. Commercial salmon set gill net effort and catch in Unalakleet, Norton Sound Subdistrict 6, 1988.

Period	Period Dates	Period Hours	No. of Fishermen	Catch (nos.) Chinook	Chum	Pink	Sockeye	Coho
1	6/20-6/21	24	45	572	442	305	0	0
2	6/23-6/24	24	48	630	952	762	1	0
3	6/27-6/28	24	48	361	2,957	7,592	0	0
4	6/30-7/02	48	38	216	2,205	6,153	2	0
5[a]	7/03-7/04	24	7	12	330	5,840	0	0
6	7/04-7/06	48	31	78	2,301	33	6	0
7[a]	7/06-7/07	12	8	8	56	3,045	0	0
8	7/07-7/09	48	31	81	2,746	0	4	0
9[a]	7/10-7/11	24	0					
10	7/11-7/13	48	28	30	1,329	0	2	3
11[a]	7/13-7/14	12	0					
12	7/14-7/16	48	32	32	2,700	0	2	3
13	7/18-7/20	48	27	42	1,205	0	1	18
14	7/21-7/23	48	22	20	1,510	0	10	38
15	7/25-7/27	48	12	8	460	0	0	41
16	7/28-7/30	48	39	20	1,542	0	5	1,230
17	8/01-8/03	48	51	24	927	0	12	2,927
18	8/04-8/06	48	54	15	691	0	4	1,763
19	8/08-8/10	48	55	16	984	0	17	4,940
20	8/11-8/13	48	48	6	444	0	3	2,428
21	8/15-8/17	48	49	9	247	0	12	2,202
22	8/18-8/20	48	52	6	237	0	14	1,783
23	8/22-8/24	48	36	11	407	0	14	2,436
24	8/25-8/27	48	46	1	232	0	14	2,253
25	8/29-8/31	48	37	9	184	0	14	883
26	9/01-9/03	48	28	6	158	0	13	816
27	9/05-9/07	48	24	5	117	0	7	468
Season Total		1,140[b]	69	2,218	25,364	23,730	157	24,265

[a] Special small mesh size fishing period directed at pink salmon.
[b] Total hours actually fished.

Appendix B.1. Thousands of chum salmon in the Kotzebue District commercial catch by age group, 1962-1988.

Year	Sample Size[a]	Age Class[b] 0.2	0.3	0.4	0.5	Total
1962	69	9.5	82.2	36.4	1.8	129.9
1963	255	16.4	27.7	10.1	0.2	54.4
1964	463	40.7	34.5	1.3	0.0	76.5
1965	480	0.9	36.4	2.7	0.0	40.0
1966	430	3.1	20.7	7.0	0.0	30.8
1967	1,865	2.6	21.3	5.4	0.1	29.4
1968	1,989	6.4	17.5	6.0	0.3	30.2
1969	1,125	21.8	34.6	2.9	0.0	59.3
1970	267	6.2	145.4	8.1	0.0	159.7
1971	1,105	11.0	103.2	40.8	0.0	155.0
1972	980	26.8	100.9	41.0	1.0	169.7
1973	598	62.7	260.9	51.8	0.0	375.4
1974	350	179.0	398.7	49.0	1.2	627.9
1975	340	14.1	488.9	60.3	0.0	563.3
1976	566	17.9	82.2	59.4	0.2	159.7
1977	446	13.1	143.1	36.4	3.3	195.9
1978	579	11.7	64.1	35.5	0.2	111.5
1979	658	43.3	75.3	21.5	1.4	141.5
1980	710	55.5	286.9	24.2	0.7	367.3
1981	1,167	16.3	453.7	207.2	0.0	677.2
1982	983	24.7	201.7	168.4	23.0	417.8
1983	1,979	10.2	101.6	60.1	3.9	175.8
1984	2,933	46.7	206.2	63.1	4.2	320.2
1985	3,293	2.3	436.4	80.6	2.1	521.4
1986	3,095	0.8	48.6	206.3	5.7	261.4
1987[c]	1,987	14.8	45.4	36.6	12.7	109.5
1988	3,324	21.5	263.6	60.8	6.8	352.7
10 yr avg (1978-1987)		22.6	192.0	90.4	5.4	310.4

[a] Sample size in numbers of fish.

[b] Age 0.6, which contributes less than 1% of the commercial harvest in any given year, is not included here.

[c] Adjusted percentages for 1987 include estimates of age composition for closed fishing periods.

Appendix B.2. Percent age and and sex composition of chum salmon samples taken from the Kotzebue District commercial fishery, 1962-1988.

Year	Sample Size[a]	Males	Females	Age Class[b] 0.2	0.3	0.4	0.5
1962	69	26.1	73.9	7.3	63.3	28.0	1.4
1963	255	35.0	65.0	30.1	50.9	18.6	0.4
1964	463	43.6	56.4	53.3	45.1	1.7	0.0
1965	480	42.1	57.9	2.3	91.0	6.7	0.0
1966	430	40.2	59.8	10.1	67.1	22.8	0.0
1967	1,865	37.3	62.7	8.8	72.3	18.5	0.5
1968	1,989	48.2	51.8	21.2	58.0	19.8	0.9
1969	1,125	53.7	46.3	36.8	58.3	4.9	0.0
1970	267	45.3	54.7	3.9	91.0	5.1	0.0
1971	1,105	54.6	45.4	7.1	66.6	26.3	0.0
1972	980	50.9	49.1	15.8	59.4	24.1	0.6
1973	598	46.0	54.0	16.7	69.5	13.8	0.0
1974	350	47.1	52.9	28.5	63.5	7.8	0.2
1975	340	46.4	53.6	2.5	86.9	10.7	0.0
1976	566	47.9	52.1	11.2	51.6	37.2	0.1
1977	446	49.3	50.7	6.7	73.0	18.6	1.7
1978	579	49.9	50.1	10.5	57.5	31.8	0.2
1979	658	53.3	46.7	30.6	53.2	15.2	1.0
1980	710	56.4	43.6	15.1	78.1	6.6	0.2
1981	1,167	52.4	47.6	2.4	67.1	30.6	0.0
1982	983	48.8	51.2	5.9	48.3	40.3	5.5
1983	1,979	43.4	56.6	5.8	57.8	34.2	2.3
1984	1,933	50.2	49.8	14.6	64.3	19.7	1.3
1985	3,293	47.8	52.2	0.4	83.7	15.5	0.4
1986	3,095	46.0	54.0	0.3	18.6	78.9	2.2
1987[c]	1,987	50.6	49.4	13.5	41.5	33.4	11.6
1988	3,324	47.8	52.2	6.1	74.7	17.2	1.9
10 yr avg (1978-1987)		49.9	50.1	9.9	57.0	30.6	2.5

[a] Sample size in numbers of fish.

[b] Age 0.6, which contributes less than 1% of the commercial harvest in any given year, is not included here.

[c] Adjusted percentages for 1987 include estimates of age composition for closed fishing periods.